



"Development of Wireless Sensor Technology for Machine Monitoring"

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Presentation Outline

- *Machine monitoring applications of wireless intelligent sensors*
- *Wireless intelligent sensor architecture*
- *Role of IEEE1451 in OST developments*
- *Summary*

Proposed Approach

The equipment tells the people when it will need attention -

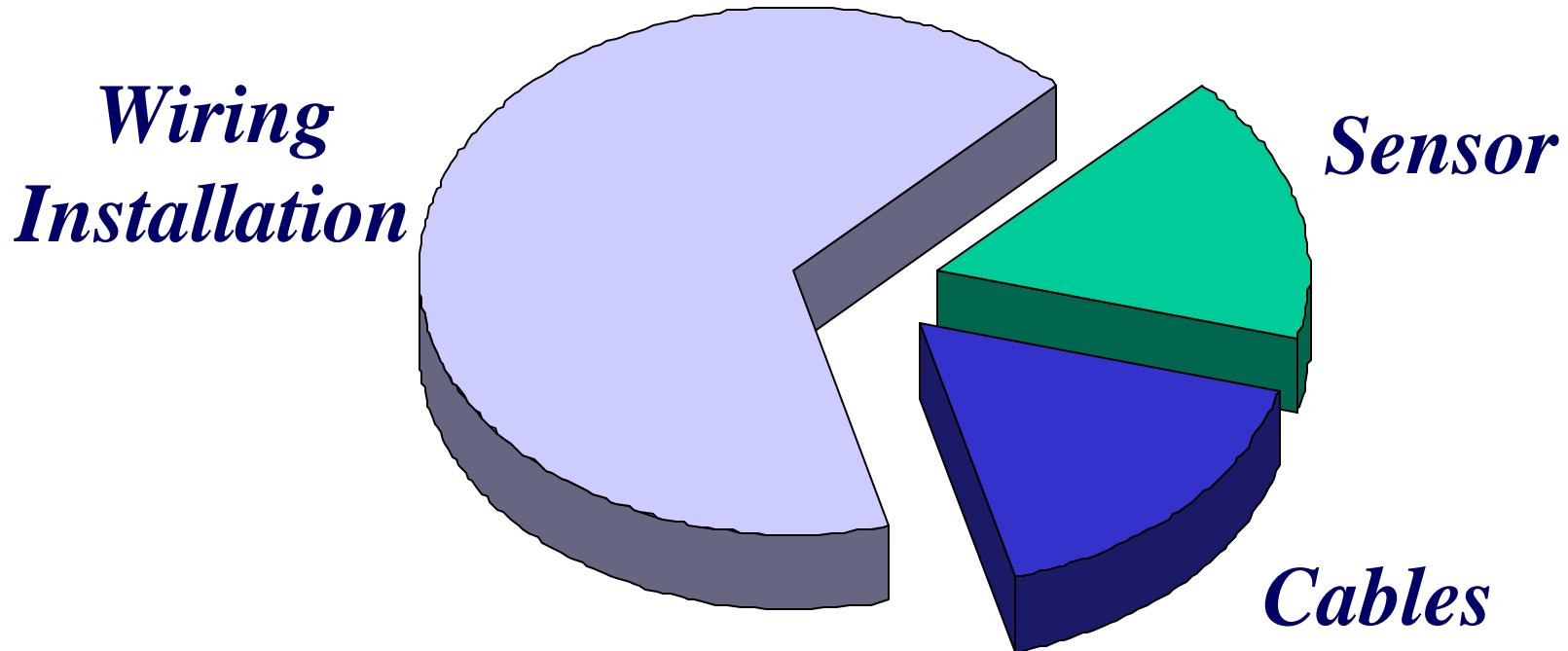
- *Intelligent platforms built from*
- *Intelligent systems built from*
- *Intelligent components*

..... *in an open architecture*

Types of sensing in machine monitoring

- *Vibration*
- *Force*
- *Pressure*
- *Temperature*
- *Electrostatic, magnetic (particulates)*
- *IR spectroscopy (fluid condition)*
-

Typical Industrial Instrumentation Costs



Wiring installation costs (including documentation) is limiting installation of needed sensors

Machine Health Monitoring Application

Platform

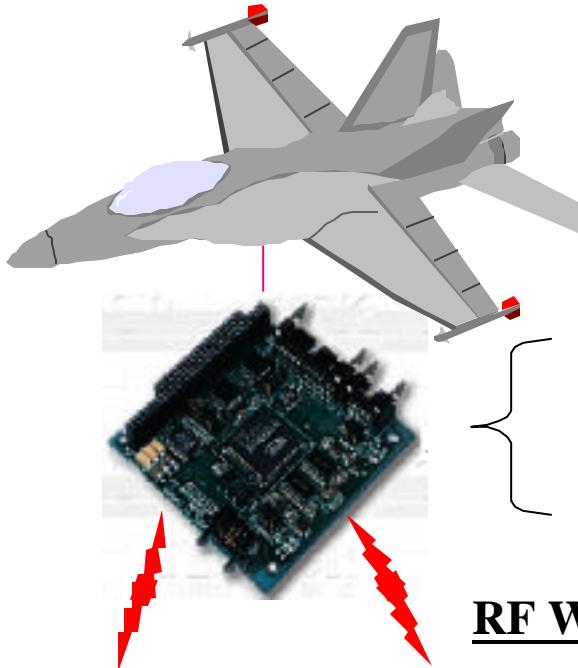
Platform Health Monitoring

SHM

System Health Monitor

ICHM™

Intelligent Component Health Monitors



ICHM™ 1
Bearing Health Monitor



ICHM™ 2
Exhaust Debris Monitor



ICHM™ "N"
Oil Condition Monitor

User Interface

Information Network (Internet)

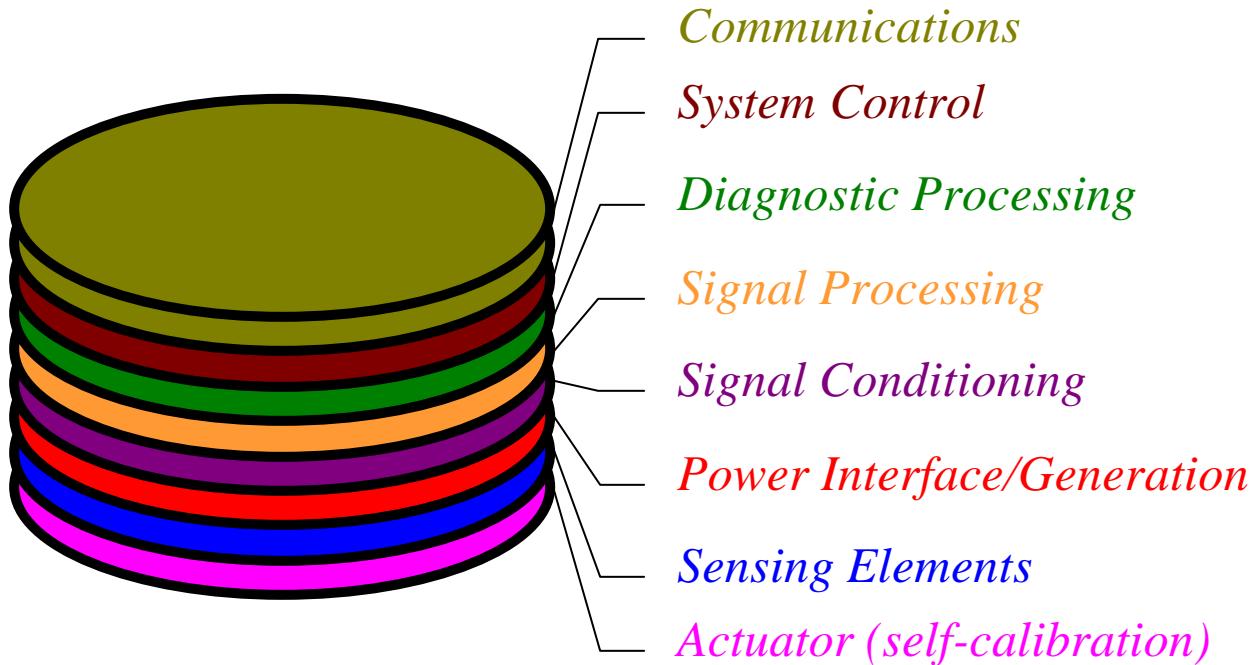
- CPU & Controllers
- Information Network Interface
- Information Archive, Prognostics

RF Wireless Link

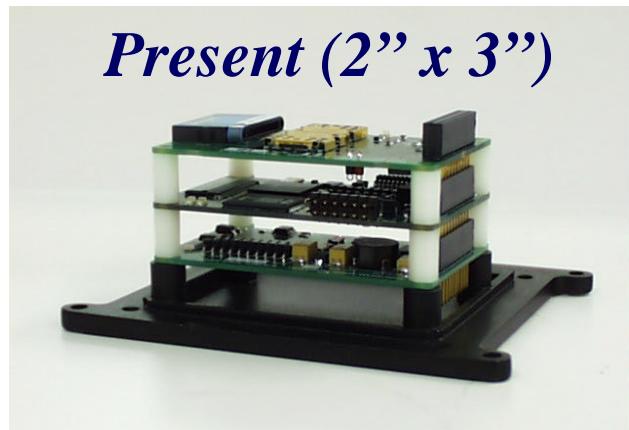
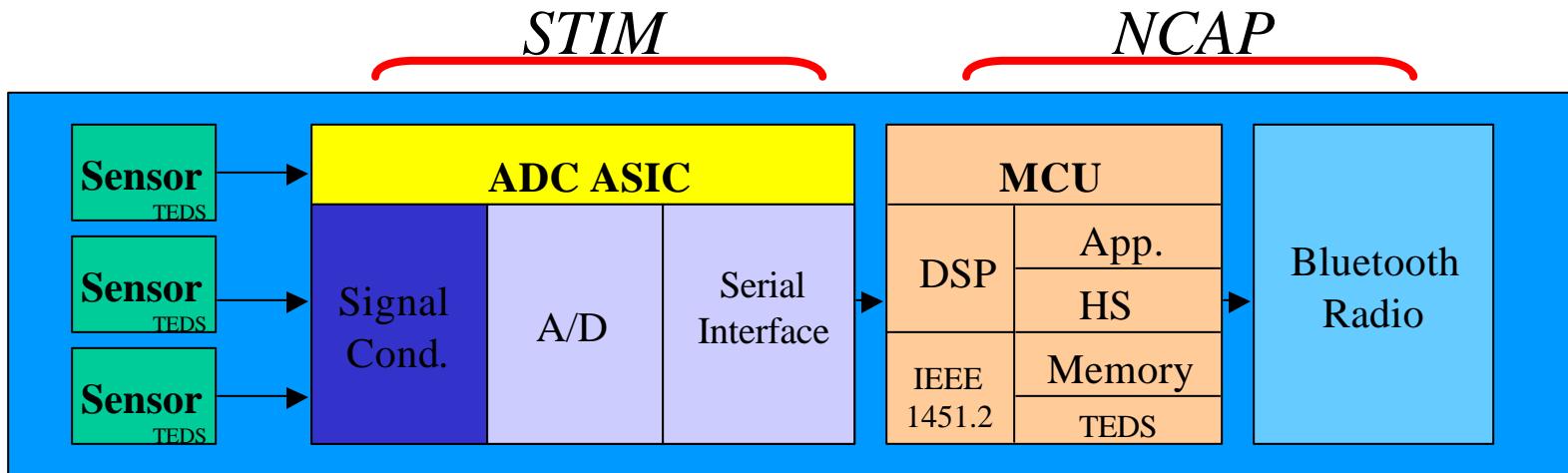


The layers of an ...

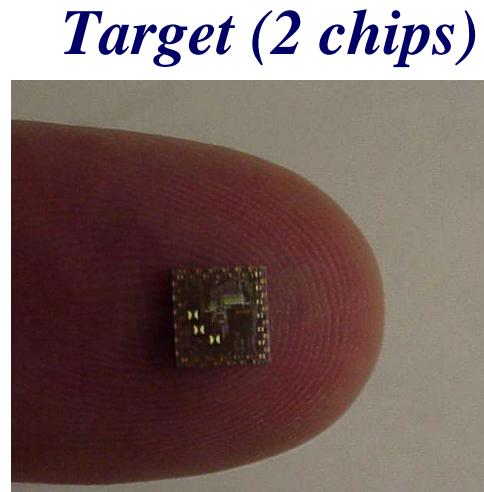
“Intelligent Component Health Monitor”



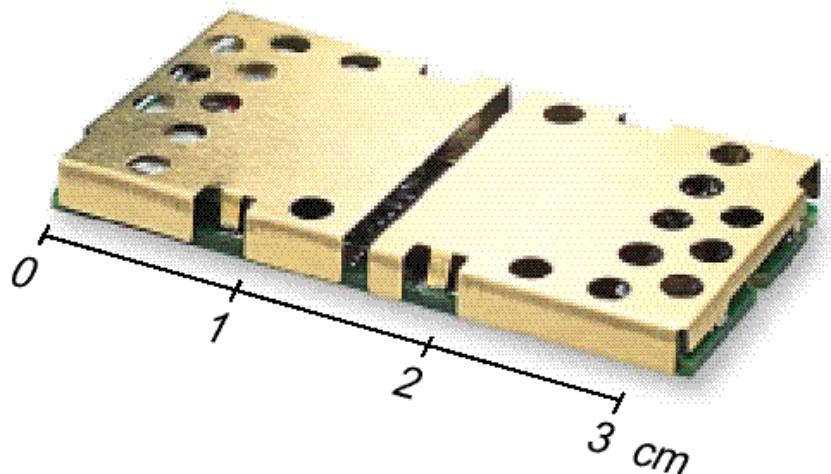
Wireless Intelligent Sensor Architecture



6 sensors, DSP, Bluetooth

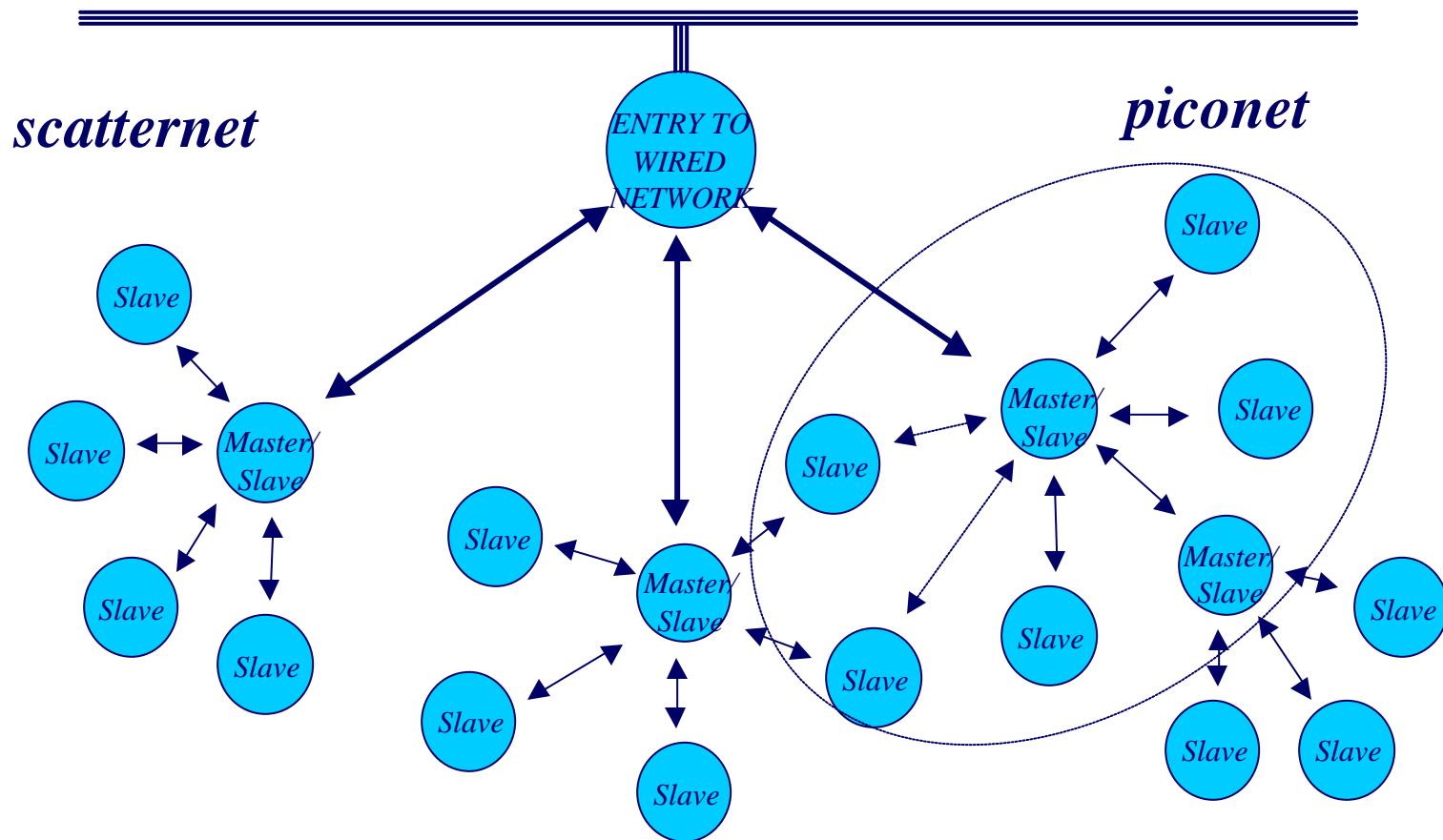


Bluetooth Wireless



- *Bluetooth may become de facto standard*
- *Digital spread spectrum, encrypted data*
- *Flexible ad hoc networking*
- *Up to 760 kbit/s*
- *1 mW -10 m ; 100 mW - 100m, ISM band*
- *Will be single chip (CMOS) soon*

Bluetooth Networking



Wireless Issues in Industrial Automation

- *Over-the-air Interoperability*
- *Synchronization*
- *Latency*
- *Physical, Electro-Magnetic Environment*
- *Security*

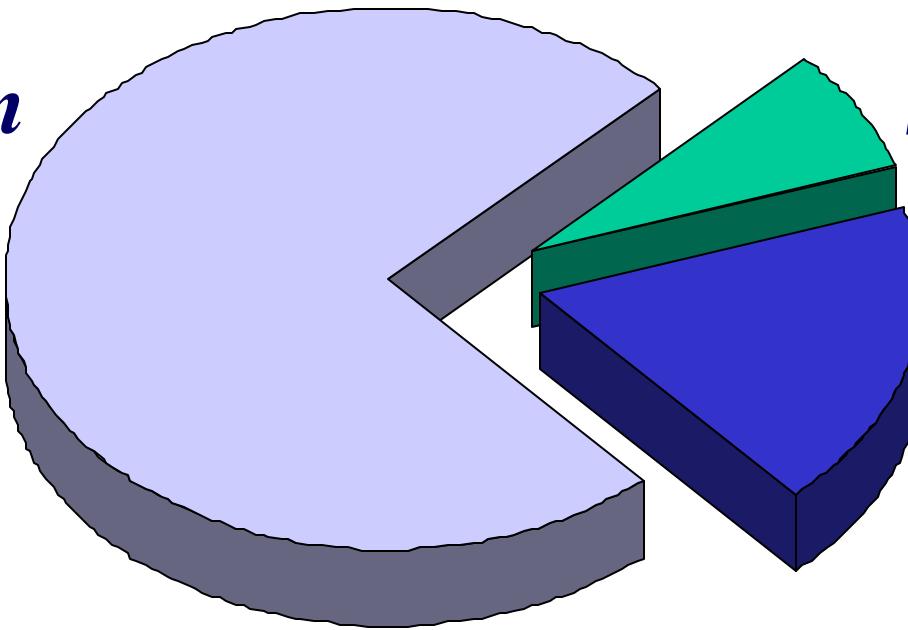
OST chairs a Bluetooth SIG Working Group to address these issues.

!! Pure Conjecture !!

Typical Sensor Integration Costs

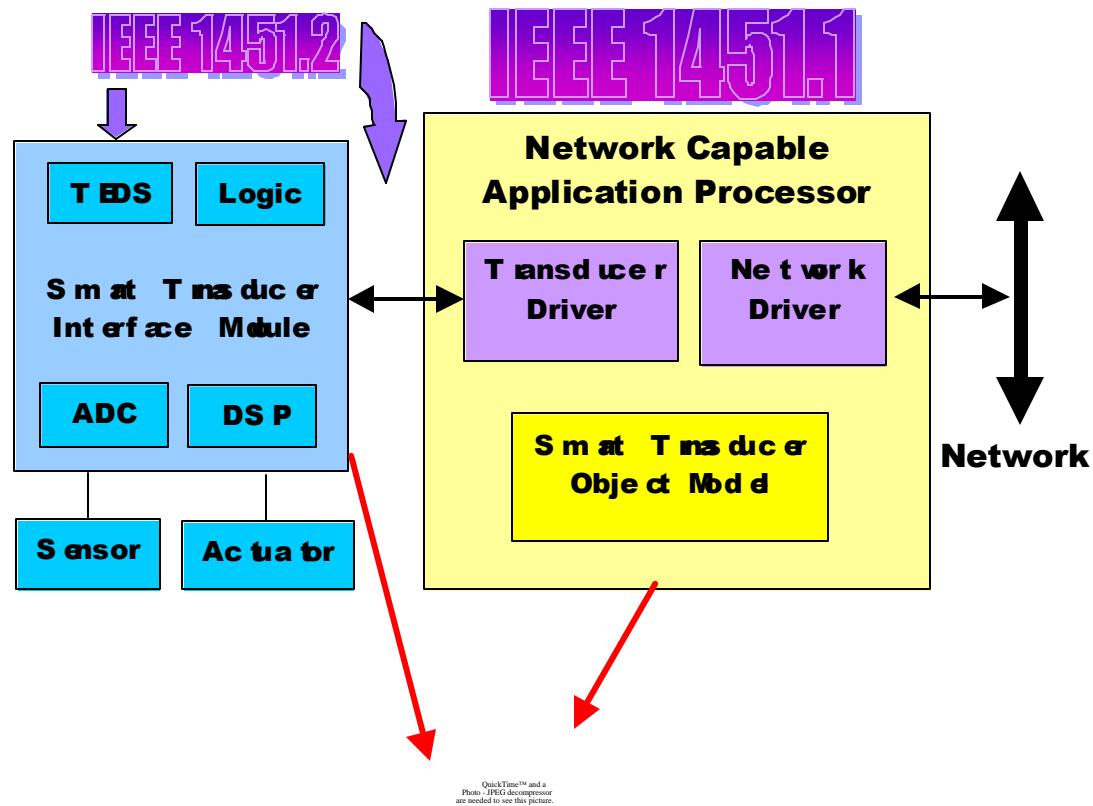
*Integration
Cost*

*Sensor
Hardware
Interface*



Sensor integration costs (including documentation) is limiting installation of needed sensors

IEEE1451 in the OST development plan

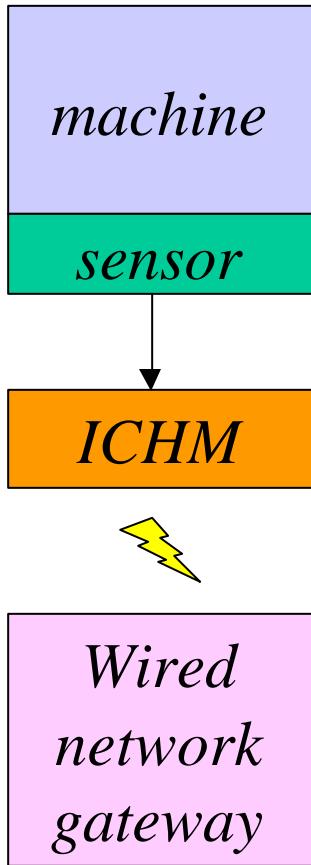


IEEE-1451

Transducer Interface Standard

- ***IEEE 1451.1***
 - *Defines the Transducer Object Model*
- ***IEEE 1451.2***
 - *Defines the interface for integration of specific smart sensors to microprocessors*
 - *Physical interface*
 - *TEDS*
 - *Protocol*
- ***IEEE 1451.4***
 - *Defines an interface to bring TEDS functionality to legacy sensor systems*

Demonstration



www.senseblue.com

QuickTime™ and a
PNG decompressor
are needed to see this picture.

Data carrying wires may be eliminated; can we remove power connections too?

- *Power grid is not always available*
- *Derive power from environment?*
 - *Vibration*
 - *Magnetic induction (rotating machines)*
 - *Solar*
 - *Thermal Energy Scavenging (hot machines)*

“Plug and Play” → “Play”

- *Key elements of strategy*
 - *Wireless communication*
 - *Open interoperable standards*
 - *IEEE1451*
 - *Bluetooth wireless*
 - *Power scavenging*